THURSDAY, MARCH 15, 1906.

TEXT-BOOKS ON PLAIN AND REINFORCED CONCRETE WORK.

(1) *Cements, Limes, and Plasters: their Materials, Manufacture, and Properties.* By E. C. Eckel. Pp. xxxiv+712. (New York: J. Wiley and Sons; London: Chapman and Hall, Ltd., 1905.) Price 25*s.* 6*d.* net.

(2) *Cement and Concrete.* By L. C. Sabin. Pp. x+507. (London: Archibald Constable and Co., Ltd., 1905.) Price 21*s.* net.

(3) *A Treatise on Concrete, Plain and Reinforced.* By F. W. Taylor and S. E. Thompson. Pp. xviii+585. (New York: John Wiley and Sons; London: Chapman and Hall, Ltd., 1905.) Price 21*s.* net.

(4) *Reinforced Concrete Construction.* By A. W. Buel and C. S. Hill. Pp. x+434. (London: Archibald Constable and Co., Ltd., 1905.) Price 21*s.* net.

(5) *Concrete Steel: a Treatise on the Theory and Practice of Reinforced Concrete Construction.* By W. Noble Twelvetrees, M.I.M.E., &c. Pp. xii+218; illustrated. (London: Whittaker and Co., 1905.) Price 6*s.* net.

(1) THIS book gives an exhaustive account of the various processes involved in the preparation of plasters, limes, and cements, and of the examination of these materials both by chemical and by physical tests. It is probably one of the most complete treatises which has been published up to the present day on this subject, and the author justifies the thoroughness of the treatment by statistics in regard to the monetary value of the cementing material annually produced in Europe and America; in the United States the monetary value of cementing materials increased from 21,773,246 dollars in 1900 to 45,607,436 dollars in 1903.

The author classifies cementing materials under two heads, viz. simple cementing materials, which include all those produced by the expulsion of a liquid or gas through the action of heat from a natural raw material, and the setting properties of which are due to the simple re-absorption of the same liquid or gas, and complex cementing materials, which include those cements the setting properties of which are due to the formation of entirely new chemical compounds during manufacture or use. Plasters are first dealt with in group i.; the process of manufacture is explained, statistics are given as to the total production of gypsum, and details of the chemical and other properties of plasters used in building work; one chapter in this section is devoted to the manufacture and properties of lime-sand bricks, which are made by mixing sand, or gravel, with a relatively small percentage of slaked lime.

As the value of Portland cement annually manufactured in the United States is three-fifths of the total value of the output of cementing materials, it is only natural that a very large portion of the book should be devoted to the questions of the manufacture and testing of Portland cement. The quarrying and other preliminary work necessary in order to obtain the raw materials from which Portland cement is made are dealt with in a series of well written and well illustrated chapters. Then follow details of the preparation of the material for the kilns, and of the best methods to employ in burning the cement and in working the kilns; this is the first text-book on this subject in which we have found a complete and detailed account of the construction and working of the modern rotary kiln. The cementing value of Portland cement depends so largely upon the fineness and character of the grinding that the author rightly devotes much attention to a description of the various grinding machines which have been devised for this work. The last portion of the book is devoted to an account of the physical and chemical tests usually employed in testing Portland cement, and the rules drawn up in 1904 by the American society for testing materials are given in full.

(2) The original investigations which form the basis of this book were made by the author in connection with the construction of the Poe Lock at St. Mary's Falls Canal, Michigan, under the direction of the Corps of Engineers, United States Army. The book is divided into four parts; in the first section a brief account is given of the different cements and limes in ordinary use, and the processes employed in their manufacture; there is a good description of the rotary kilns now often used in making Portland cement.

In part ii. the author deals with the various physical tests usually enforced in examining Portland cement in order to ascertain its quality and its suitability for various purposes, and a series of tables is given of the results of tests made by the author in connection with the works at St. Mary's Falls Canal. In the last chapter of this section the author explains carefully the method adopted at these works for recording the receipt of Portland cement from the manufacturers, the methods adopted for storing it, and for keeping the records of the various tests made from sample barrels selected from each delivery; this chapter will be found very useful as a guidance by any engineer who may have to undertake similar work.

The question of the correct proportion of the various ingredients in concrete, and the methods employed in mixing them, are dealt with in part iii., and a number of tables is given for enabling in any case a determination to be made of the percentage of voids present in broken stone of various classes when broken to varying degrees of fineness; this portion of the book is of an extremely practical nature, and contains a great deal of useful information. The last portion of this section is devoted to the testing of concrete, and the results of a carefully arranged series of tests carried out by the author are given in tabular form. This portion of the book also deals with the question of the determination of the modulus of elasticity of concrete, and with such important points as the change in volume during the process of setting, resistance to fire, and other matters of a similar nature.

The last section of the book, part iv., is devoted to a description of the various classes of work for which cement concrete is most useful, and the question of reinforced concrete, or concrete-steel, as the author prefers to call it, is taken up. In the last few chapters the methods of applying concrete—both plain and reinforced—in large structures such as subways, arches, reservoirs, retaining walls, dams, &c., are fully explained. The book has a good index.

(3) The whole question of concrete work, both when used by itself and when employed in combination with steel, or reinforced concrete, as it is technically known, is fully dealt with in this elaborate treatise. The first portion of the book is devoted to the properties of Portland and other cements, and includes an interesting chapter which deals with the chemistry of hydraulic cements, and which has been specially written for the book by a chemist, Mr. S. B. Newberry. The authors then deal with the question of the ordinary standard tests of Portland cement, and quote the recommendations of the French Commission of 1893, and of the special committee of the American Society of Civil Engineers, appointed in 1904. There are a number of first-rate illustrations of the various appliances which are needed, and full explanations are given as to the best way of carrying out these standard tests. In addition to the standard tests, special tests, such as those on compression, adhesion, &c., are also discussed. This portion of the book will be found extremely useful for reference purposes.

Two chapters deal with the questions of the method of determining the laws of volumes and voids in concrete work, and the right methods of proportioning the ingredients used in making are explained in detail. The methods described may seem almost too elaborate, but there is no doubt that it pays well when concrete is to be used on a large scale to spend a considerable amount of time and trouble beforehand in determining exactly the best possible mixtures of cement, sand, and broken stone in order to produce the most economical as well as the strongest concrete suitable for the work which has to be carried out.

The authors then begin the subject of reinforced concrete, and, after discussing the values which should be used for the moduli of elasticity of concrete, both in tension and compression, go on to deal with the problem of the moment of resistance of a reinforced beam. The formulæ obtained are fairly simple, and may be said to be approximately correct, since the neglect of the tensile stress taken up by the concrete is perfectly reasonable in designing such beams. It appears to us very inadvisable in our present state of knowledge to attempt to use extremely elaborate formulæ in calculating the strength of reinforced beams, since the values obtained by different experimenters, and even by the same experimenter, for the moduli of elasticity of concrete differ by such large amounts, and the assumption that the stress-strain diagram is a parabolic curve seems to us quite unwarranted by the experimental data available up to the present time.

The authors then give some convenient tables for use in the calculation of the strength of beams and slabs which are continuous over supports, and work out a number of examples to illustrate the use of these tables. In dealing with the mixing of concrete, a number of illustrations is given of the various types of mechanical mixers now used when concrete has to be made on a large scale, including mixers fitted with automatic measuring plants in order to keep the proportions of the various materials absolutely uniform. A special chapter in this section has been written for the book by Mr. R. Feret upon the effect of sea-water upon concrete.

A few chapters then follow on the question of the effect of frost upon concrete, both during the time of depositing the concrete and after the concrete has been deposited, upon the necessary proportions of the various ingredients in order to secure absolute water-tightness in any given mass of concrete, and upon the protection afforded to iron and steel when used in reinforced concrete against fire and rust. The remaining chapters of the book are devoted to details of concrete work in various situations, such as sidewalks of streets, floors and walls of buildings, foundations and piers for bridges, retaining walls, sewers, subways, arches, reservoirs, and tanks, and the most economical method of strengthening such concrete by steel reinforcements. A very good bibliography of the subject, and some appendices dealing with the formulæ for the strength of beams, conclude a very valuable book.

(4) This is a treatise for engineers engaged in the design and construction of works in reinforced concrete, and is based mainly on American practice. The book is divided into three parts; in part i., for which Mr. Buel is responsible, after a brief explanation of the properties of cement concrete and steel, the methods of calculation are dealt with; simple formulæ are deduced for the strength of beams, both for the case when the tensile strength of the concrete is taken into account, and when it is neglected; the more important of the empirical formulæ, such as those due to Thacher, Christophe, and Hatt, are then explained, and two very complete tables are given for the safe loads in reinforced slabs of various spans, based on Thacher's formula.

The design of reinforced columns is then discussed, and the author by a series of tables shows how closely the strengths of such columns, deduced from the formulæ he gives, agree with the actual crushing strengths obtained in a series of tests at the Massachusetts Institute of Technology. The application of this system of construction to retaining walls, dams, sewers, &c., is very fully explained, several neat graphical constructions being given; and in this chapter the author deals with the very important problem of the use of steel reinforcement to prevent the cracks liable to occur in large concrete structures, such as dams and retaining walls, due both to shrinkage in setting and to thermal stresses, and he is of opinion that high carbon steel is more economical for this purpose.

In the last chapter of this section the testing and design of reinforced concrete arches are taken up; after a brief explanation of the elastic theory and its application to the determination of the stresses in any arch, Thacher's formulæ for reinforced concrete arches are given, and their use in practice explained by the help of three typical examples of such arches, a highway bridge of two spans, each of 42½ feet, a single-line railway bridge of 72-feet span, and, lastly, a small semicircular arch culvert of 15 feet span. These three examples are completely worked out, the necessary graphical constructions being shown in full in three plates; this chapter will undoubtedly be found very useful to any engineer who is engaged in the design of such arches.

Parts ii. and iii. are the work of Mr. Hill, and deal respectively with representative structures and methods of construction; the following branches of work are dealt with:—foundations of various types, including reinforced concrete piles, floors, walls and arches in buildings, and columns. The illustrations selected, though largely American, include also a number of cases of work carried out in Europe on the Hennebique system. The application of reinforced concrete to large bridges and culverts is illustrated by a number of structures which have recently been put up in France on the Monier system, and it may be pointed out that some hundreds of bridges of this type have now been erected, principally in Germany and Austria.

The last section of the book, on methods of construction, is naturally largely taken up with the description of the various forms necessary in elaborate reinforced concrete work. The future security of the work depends entirely upon the care with which the forms are designed and erected, and the economy of the work is largely dependent upon forms so designed that they can be rapidly put into position, readily taken down, and readily re-erected on a fresh section of the work. Many valuable hints and labour-saving suggestions will be found in this portion of the book. The author has evidently based this section upon experience of a very varied character in the erection of reinforced concrete structures.

(5) This is another of the somewhat numerous text-books which have appeared within the last few months dealing with the important subject of reinforced concrete. The author points out that the use of steel merely embedded in stone or concrete, as in the well known skeleton system of construction, does not develop the best properties of each of these materials—reinforced concrete alone enables full advantage to be taken of the special qualities of both the steel and the concrete.

The first portion of the book deals with the physical properties of the two materials, concrete and steel, and a number of carefully selected tables is given of tests of these materials. The general theory of concrete-steel beams is then considered, and special emphasis is laid upon the necessity of an accurate knowledge of the moduli of elasticity.

We are afraid, however, that the author has fallen into confusion of thought in discussing the question of the position of the neutral axis; on p. 43 he refers to an imaginary beam of concrete and steel, and appears to consider that each square inch of the concrete will carry the same total stress, ignoring altogether the variation in intensity of stress with distance from the neutral axis; and again, in chapter iv., when discussing the position of the neutral axis, he states that the position of this is affected by the fact that the compressive strength of the material (concrete) is greater than its tensile strength. Surely there is confusion here between strength and modulus of elasticity, and this confusion seems to run through all the rules and calculations for the position of the neutral axis. This portion of the book certainly requires to be carefully revised if it is to become a trustworthy text-book on the subject.

The subject of floor design in concrete and steel is taken up, several large floors constructed on the Hennebique system are fully described, and tables are given of working stresses which can be allowed, and the building rules which have been laid down by various authorities in connection with the design of such floors. The application of reinforced concrete to foundation work in bad soils is discussed, and the author shows that by the use of this type of construction the depth to which the foundation must be taken can be very considerably reduced. The last chapter discusses the construction of reinforced concrete columns, special attention being given to Considère's hooping method.

CHEMISTRY FOR SCHOOLS.

Notes on Volumetric Analysis. By J. B. Russell and A. H. Bell. Pp. viii+94. (London: John Murray.) Price 2*s*.

Introduction to Chemical Analysis. By Hugh C. H. Candy. Pp. xii+114. (London: J. and A. Churchill, 1905.) Price 3*s*. 6*d*. net.

An Elementary Text-book of Inorganic Chemistry. By R. L. Whiteley. Pp. viii+245. (London: Methuen and Co.) Price 2*s*. 6*d*.

Elementary Chemistry, Progressive Lessons in. By F. R. L. Wilson and G. W. Hedley. Pp. xii+168. (Oxford: The Clarendon Press, 1905.) Price 3*s*.

A Three Years' Course of Practical Chemistry. By George H. Martin and Ellis Jones. Pp. viii+112. (London: Rivingtons, 1906.) Price 2*s*.

IT seems to have become a recognised practice for schools and colleges to produce their own small text-books or notes on some portion of the science curriculum, first for internal use, and then for the benefit of outsiders. Whether this multiplication of little books is desirable is somewhat questionable. Without going so far as to say that these small books conduce to cramming or getting through examinations, there is always a slight lurking suspicion about this point. Our various "examination" boards are perhaps answerable for the small book production.

Mr. Russell's book is intended, no doubt, for use on the working bench. The directions for working are short, mainly to the point and in logical order, but surely they are too frequently repeated.